



## Yield, water productivity and economics of legume based agri-horti systems during establishment phase of pomegranate (*Punica granatum*) in hyper arid partially irrigated zone of western Rajasthan

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### ABSTRACT

Field experiment was carried out at farmer's field in pre-bearing orchard of pomegranate (*Punica granatum* L.) during *rabi* and *kharif* season of 2015-16 and 2016-17, respectively in Bikaner district of Rajasthan to study the yield, water productivity and return of legume based intercropping during the establishment phase of pomegranate. There were five treatment combinations, i.e sole pomegranate, pomegranate + (fenugreek-clusterbean), pomegranate + (wheat-groundnut), sole fenugreek-clusterbean and sole wheat-groundnut. Pomegranate planted at 4m × 3m was maintained with drip and intercrops with mini-sprinkler irrigation system. Intercrops showed positive effect on height, girth and canopy spread of pomegranate over sole plantation. In agri-horti systems, the productivity of fenugreek, wheat, clusterbean and groundnut were higher by 20.5, 15.1, 16.4 and 14.9 %, respectively in grain and 18.0, 15.0, 31.6 and 12.4 %, respectively in straw/stover, as compared to sole cropping. The increase in productivity in agri-horti systems may compensate the area sacrificed by canopy coverage of trees up to some extent. Wheat-groundnut intercropped with pomegranate produced higher system productivity (5376 kg/ha) over fenugreek-clusterbean intercropped with pomegranate as well as sole fenugreek-clusterbean. Water productivity of sole orchard can be improved to 0.21 and 0.39 kg/m<sup>3</sup> in terms of economic yield (WP<sub>EY</sub>), 0.64 and 0.99 kg/m<sup>3</sup> in terms of biological yield (WP<sub>BY</sub>) and ₹ 108.8 and ₹ 151.1 /ha/mm, respectively in monetary terms by incorporating fenugreek-clusterbean and wheat-groundnut intercropping systems, respectively.

**Key words:** Agri-horti systems, Economics, Water productivity, Yield

About 31.7 million hectare (m ha) area of India (12% of country's total geographical area) has an arid climate, out of which 62 % area falls in Thar desert of western Rajasthan. This region is characterised by both physical and economic water scarcity. The greater proportion of agriculture in this region is resource constrained, subsistence and practiced under rainfed conditions. Under these conditions, reports of yield losses associated with water stress and soil erosion are common (Soni *et al.* 2013; Santra *et al.* 2017).The

arrival of water in the Thar Desert through Indira Gandhi Nahar Pariyojana (IGNP) has opened up land for irrigation and it became agriculturally productive zone. With the advancement of irrigation facility, growing of suitable horticultural crops are also becoming popular along with annual crops.

Pomegranate (*Punica granatum* L.) is gaining importance as an important fruit crop of arid and semi-arid region of India (Prasad 2000). The crop is grown commercially due to its high economic return, therapeutic and nutraceutical value (Sharma and Maity 2010) and its suitability for marginal lands without much care. The farmers grow the fruit crops as sole crop and the interspaces are left unused. Suitable crop combinations in the interspace of orchard during initial years can generate extra income, enhance productivity, ameliorate and improve ecological situation (Awasthi *et al.* 2008) in a sustainable manner.

In agri-horti systems, the selection of crop is most important. A careful selection of intercrop can reduce the mutual competition of resources to a considerable extent and may provide additional income to the farmers. Keeping in view the limitations of available water in the region, the

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